Printing Ink is a complex mixture of ingredients that are combined in a specific formulation to meet desired characteristics of the printing application of the ink. This article will focus on no-heat printing ink formulations and how they are derived. Ingredients in no-heat inks fall into four major classifications: Pigments, Resins, Oils or Carriers, and Additives.

The function of the pigment is to provide the coloristic properties of the ink. The resin is added as a dispersion aid and also as a binder to affix the pigment to the paper. The oil or carrier is the medium for transferring the pigment and resin through the press to the paper. Additives are used in no-heat inks to control pigment wetting and dispersion, viscosity and flow characteristics, as well as to provide a proper ink/water balance.

Figure 1

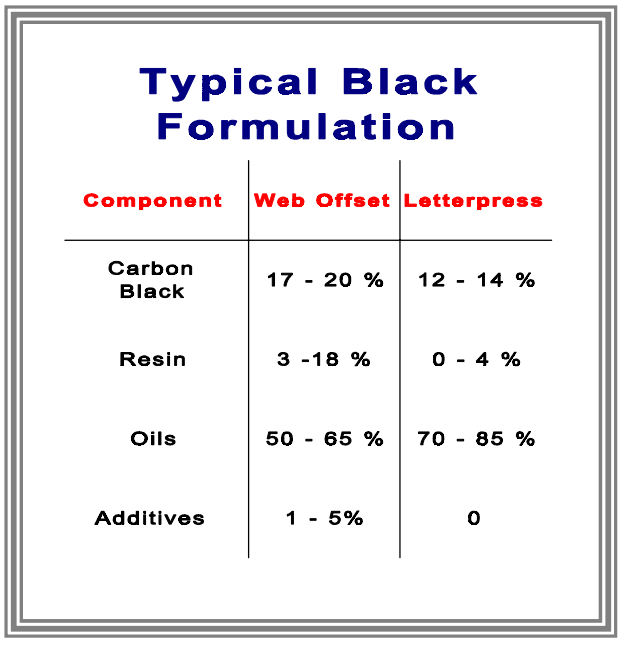

Figure 2

To review these ingredients in more detail, let us look at some news ink formulations. Figure 2 shows typical black formulations for both the Web Offset and Letterpress printing techniques. The ingredients used in these types of formulations are both similar, however they are different in concentration.

The pigment used in news ink blacks is carbon black. Carbon black is produced by cracking oil in a continuous furnace. These furnaces are highly controlled in order to produce a specific grade of pigment varying in particle size and structure. The oil used is also of a specific grade so that certain requirements can be met. The ink film thickness applied by the printing application dictates the concentration of pigment needed to meet the

required print density. As you can see from the typical formulations, the web offset ink has a higher concentration of pigment than that of the letterpress. This is because the letterpress printing process applies a much thicker film of ink than web offset.

Resins for news ink vary depending on the rub off quality that an ink requires. The resins are the most expensive part of a news ink black, so their selection and concentration are limited by economic restraints. The oil or carriers used in today's news black are treated naphthenic petroleum oils. These oils are non-drying. The drying process of a news ink is by absorption of this oil into the paper stock. Changes in the absorption characteristics of the newsprint can drastically affect the rub off quality of the finished product also.

The oils are non-drying under press conditions and are designed this way. Typically newspaper presses are not temperature controlled nor are the rollers washed up at the end of a run. If any volatile material were used, the ink would tend to dry on the roller train and cause problems. The heatset printing process by contrast uses volatile oils in their printing process. These oils are driven off the ink film by passing the printed web through an oven, thus leaving only the pigment and resins on the printed sheet. This would explain why heatset will have better rub off characteristics.

Additives used in news black are from a variety of different materials. News ink black will require different viscosity or flow characteristics depending on the type of press used. The ink is also required to provide a proper emulsification rate so that the web offset printing process will work. If a formulation did not accept any fountain solution, the ink would not transfer to the plate and stripping would result. If an ink emulsified too much fountain solution, high dot gain and poor print quality would result. In extreme cases, ink would tend to go to the non-image area of a plate and scum.

Figure 3 shows a typical color ink for a newspaper ink. The pigments used in news ink colors are what are classified as organic pigments. Organic pigments are synthetic materials that are formed under specific conditions to produce the desired characteristic of color and crystal size. The typical pigments used are Phthalocyanine blue for cyan, Lithol Rubine for magenta, and Diarylide yellow for yellow. Pigments for the printing ink industry are supplied in the form of heavy concentrated bases or "Flushes." In the normal course of pigment manufacture, the color pigment is produced in an aqueous environment. After synthesis, the color pigment is filtered from the suspension and dried to produce dry color. In producing the flush color, the pigment is not fully dried. The water-based slurry is concentrated to approximately 20 to 30% pigment. The slurry at this point would be called a

presscake. The presscake instead of going through the drying process would be mixed with an oil-based varnish. The two components are kneaded together in a mixer. The pigments have a greater affinity for the oil-based material. The water is "flushed" out or displaced by the varnish as the pigment migrates from the water phase into the oil. This process is continued until all the water is removed, thus creating the flushed color.

The resins used for colors tend to be much cleaner in color than those used for black inks, so that the printed color can reflect its truer color. The oils used by the newspaper market today are from the vegetable family. The newspaper market found that the soybean oil type formulations produced a better product for this application. Soybean oil is a naturally renewable resource, which is extracted from the bean. The food industry would also use this type of oil in some of their products.

Typical Color Formulation

Component	Web Offset	Letterpress
Pigment	10 - 15 %	7 - 10%
Resin	10 - 25 %	5 - 10 %
Oils	30 - 45 %	75 - 85 %
Pigment Extenders	10 - 20%	0 - 10%
Additives	1 - 5%	0

Figure 3

Colored printing inks also use extender pigments. These pigments are typically kaolin type clays and provide functional properties to a given formulation. The additives used in colored inks will be of a similar nature to that of a news black.

In formulating newspaper inks, it is not only important to have the proper ingredients, but the proper manufacturing and quality control techniques for a good quality news ink. In future articles we will discuss these topics in greater detail.